

## 7. EDUCATION AND PUBLIC OUTREACH

The Laboratory for Atmospheres actively participates in NASA's efforts to serve the education community at all levels and to provide information to the general public. The Laboratory's educational outreach component is consistent with the Agency's objectives to enhance educator knowledge and preparation, supplement curricula, forge new education partnerships, and support all levels of students. Laboratory activities include addressing public policy, establishing and continuing collaborative ventures and cooperative agreements; providing resources for lectures, classes, and seminars at educational institutions; and mentoring or academically advising all levels of students. Through our public outreach component, we seek to make our scientific and technological advances broadly accessible to all members of the public and to increase their understanding of why and how such advances affect their lives.

### Public Policy

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*High End Climate Science: Development of Modeling and Related Computing Capabilities* (known as the *Rood Report*) was released early in 2001 and is available on <http://www.usgcrp.gov/> under "What's new." This report is the result of a panel chaired by Richard Rood of the Data Assimilation Office and written at the request of the White House Office of Science and Technology Policy. Other panel members were Jeff Anderson (GFDL), Dave Bader (DOE), Maurice Blackmon (NCAR), Tim Hogan (DOD), and Pat Esborg (Organizational Consultant).

### Interaction with Howard University and Other Historically Black Colleges and Universities

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A part of NASA's mission is to initiate broad-based aerospace research capability by establishing research centers at the nation's Historically Black Colleges and Universities (HBCUs). The Center for the Study of Terrestrial and Extraterrestrial Atmospheres (CSTEa) was established in 1992 at Howard University (HU) in Washington, D.C., as a part of this initiative. The Laboratory for Atmospheres started a close collaboration with CSTEa in the second 5-year period of NASA funding under a cooperative agreement grant. It is the goal of NASA and the mission of CSTEa to establish at Howard University a self-supporting, world-class facility for the study of terrestrial and extraterrestrial atmospheres, with special emphasis on recruiting and training African Americans for careers in Earth and space science.

The Laboratory continues its research and educational activity with Howard University's CSTEa program. A Technical Review Committee site visit has been held yearly to evaluate the CSTEa program, to make recommendations for the program's research and collaborative interactions with the Laboratory, to help the program with its strategic planning for future growth, and to help the program develop new funding sources. The Laboratory works closely with CSTEa faculty to promote the Howard University Program in Atmospheric Sciences (HUPAS). HUPAS is the first M.S.- and Ph.D.-granting program in atmospheric sciences at an HBCU and the first interdisciplinary academic program at Howard University. Scientists from our Laboratory contribute to the HUPAS program as lecturers, advisors to students, and adjunct professors teaching courses. Laboratory for Atmospheres Adjunct Professors Dean Duffy and Richard Stewart wrote parts of the first Ph.D. candidacy exams for HUPAS. In another example of

collaboration, a video on the origin of UV-B and its health implications for the people of Madagascar was prepared at the Howard University TV station for presentation on Madagascar national TV with the aid of a Laboratory scientist and using our Laboratory's TOMS data. Dr. A. Aikin prepared the script, which was delivered in French and Malagasy by M. Robjohn, a student from Madagascar studying atmospheric sciences at HU.

The Laboratory continues its enthusiastic support for the Goddard/Howard University Fellowship in Atmospheric Sciences (GoHFAS) program. GoHFAS was established in 1999 to broaden and strengthen the research and educational opportunities of underrepresented minorities. The students attend a summer program at Howard University where they engage in research with mentors at HU, GSFC, or NOAA. They attend a for-credit class in atmospheric science and a technical writing and presentation class. They receive fellowships at their home institutions during their senior year and are given an opportunity to come to HU during the winter break to continue their research. A significant number of GoHFAS students have successfully transitioned into CSTE and HUPAS graduate degree programs.

Another example of efforts by our Laboratory scientists to encourage underrepresented minorities to enter the sciences is given by the activities of Dr. J. Marshall Shepherd. Dr. Shepherd participated in the Quality Education for Minorities (QEM) Ask a Scientist Activity in February in Washington, D.C., with roughly 25 professional scientists from various disciplines fielding questions from over 100 students and parents attending the conference. He participated in a NASA Awareness Program at Jackson State University in October. Dr. Shepherd also gave a seminar entitled "TRMM Observations and Numerical Investigations of Urban-Induced Rainfall Anomalies" at Clark Atlanta University to spur development of a partnership with Clark Atlanta in support of his current urban rainfall research initiatives.

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### **Summer Mentoring Programs**

Our Laboratory participates in a number of programs that bring graduate and undergraduate students to work one-on-one with scientists and engineers in the Laboratory for Atmospheres as well as in other Laboratories and Directorates at Goddard. The GoHFAS collaboration with Howard University was mentioned in the previous section. The Summer Institute on Atmospheric and Hydrologic Sciences program is the longest running program. This past year 16 students were hosted in the Earth Sciences Directorate with 8 in the Laboratory for Atmospheres. This program is now administered by the GEST Center as the Visiting Student Enrichment Program (VSEP). Information on VSEP can be found on the World Wide Web at <http://www.umbc.edu/gest/> under Student Opportunities. Student projects in the past have included simulating neural networks, preparing image analysis algorithms on supercomputers, developing computational science applications, and creating interactive World Wide Web sites. Two other programs that are bringing students to our Laboratory for mentoring are the GSRP (Graduate Student Researchers Program), funded by NASA, and the SOARS (Significant Opportunities in Atmospheric Research and Science) program, funded by UCAR. All these programs are designed to stimulate interest in interdisciplinary Earth science studies by enabling selected students to pursue specially tailored research projects with Goddard scientific mentors.

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### **University Education**

At the university level, Laboratory scientists have taught undergraduate and graduate courses, given seminars and lectures, and advised degree-seeking students. Over 20 Laboratory scientists supervise graduate students and have official affiliations (i.e., adjunct or visiting professor) with various universities, and 14 regularly teach university-level courses. As an example of our scientists' mentoring of graduate students, David Starr participated in the Ph.D. dissertation

defense of students at Colorado State University and Pennsylvania State University, and the students followed up their graduate work with visits to our Laboratory. Alexander Marshak served on the Ph.D. committee for two dissertations at Boston University Department of Geography on these topics: “Evaluation of the Performance of the MODIS LAI and PFAR Algorithm with Multiresolution Satellite Data” and “Application of Stochastic Radiative Transfer to Remote Sensing of Vegetation.”

Our scientists give seminars in a variety of national and international settings. Dr. Song Yang was invited to Nanjin and Beijin, China, in July and visited two universities (Nanjin Institute of Meteorology and Nanjin University) and three research institutes (Institute of Atmospheric Physics, National Satellite Meteorological Center, and the Meteorological Center of China Meteorological Administration) where he presented 7 TRMM seminars. This peer outreach helps extend the impact of TRMM on atmospheric sciences in China with the expectation that research scientists in China will increasingly apply TRMM data to advance our understanding of weather systems and climate. Anne Thompson gave a seminar in the Oceanography Department at Dalhousie University (Halifax, Nova Scotia) on July 23 and discussed SHADOZ (Southern Hemisphere Additional Ozonesondes) and the forthcoming SOLAS (Surface Ocean Lower Atmosphere Studies) international project with department members.

In an example of outreach to universities in areas outside of our specific basic research focus, Anne Thompson and Jay Herman (916), Nancy Maynard (900), Elissa Levine and Dan Kimes (923) attended the Workshop on Human Health, Urbanization, and Remote Sensing, held at the Emory University Rollins School of Public Health (Atlanta) in May. As a result of the workshop, five specific health and urbanization issues that can be approached through remote sensing were selected for follow-up study by NASA, university, EPA, NIEHS (National Institute of Environmental Health Sciences), and CDC (Centers for Disease Control) researchers.

### **K–12 Education**

Laboratory staff participated in K–12 education in a variety of ways. Laboratory scientists routinely present lectures and demonstrations to K–12 schools and youth groups to help develop an early interest in science. Many Laboratory scientists have also mentored students in grades K–12. The Eleanor Roosevelt High School Science and Technology Internship Program enables high school students to perform research under the mentorship of Laboratory scientists. As an example, Candice Chan, a student at Eleanor Roosevelt High School, was mentored by Drs. Gerald Heymsfield and Lin Tian and competed in the Prince George’s Area Science Fair (including Prince George’s, Calvert, Anne Arundel, and Charles Counties), taking third place in the Earth Sciences category. Her project was titled “Characteristics of the Radar Bright Band” and involved analysis of ER-2 Doppler Radar (EDOP) observations. She has received awards from The Johns Hopkins Applied Physics Lab, National Space Club, Friends of Agricultural Research, and TRW. Members of the Laboratory have served as judges for local science fairs and made presentations at high school career days to foster interest in NASA-related research. This educational outreach teaches students how many of us chose our scientific careers and what steps we took to achieve our positions. In another example, Dr. George Huffman and Mark Malanoski presented Earth Science demos to four groups (totaling approximately 130) of 5th–8th graders and their teachers in the D.C. Public Schools Higher Achievement/Scholar program during their site visit to GSFC in August.

In a significant example of K–12 outreach outside of the U.S., Richard Stolarski participated in the “Ozone Awareness Program” at Cannock Chase High School in October. The teachers and students at the high school spent the previous year developing an ozone awareness program and a

Web site, <http://www.cannockchase-high.staffs.sch.uk/ozone/ozoneindex.htm> The site was inspired in large part by the ozone research carried out in our Laboratory, and made extensive use of the TOMS data. As part of its program, the school obtained funds from a number of educational sources within the U.K. to bring a NASA scientist to the school to talk about ozone science and to stimulate students into following science as a career choice. Dr. Stolarski spoke to over 300 students and was interviewed by BBC news. In an email, Mina Patel, who organized the student project and lobbied for the NASA visit, wrote: "I would like to let you know on behalf of the Headmaster at Cannock Chase High school, just how much of a pleasure it was for us to have Rich Stolarski come to speak to our pupils. He was truly inspirational to so many of our youngsters. Thank you so very much for supporting my school and me. Regards, Mina."



Presentation to about 170 students in their 8th year at Cannock Chase High School, U.K. Quote from Dr. Stolarski's report: "I talked to them for about 40 minutes about the excitement of doing science. They were excited and fun and asked lots of questions. Overall, it was a fun experience. The teachers and students were enthusiastic. I was reminded that people consider being a NASA scientist as something special. I hope that I contributed positively towards the eventual career decisions of some of the students."

### Public Outreach

Informing the public of how their tax dollar investments are working for them within the Laboratory is a critical subset of the Center and Agency public outreach mission. Laboratory scientists, working with other Laboratories at Goddard and outside institutions, continue to pass their knowledge and interest in Earth and space science to the general public via public information and education programs. Our scientists and engineers have been interviewed by the news media, have appeared in press conferences, have generated Web sites, CDs and educational material oriented toward the general public, and have participated in public forums.



Some of our outreach addressed the CAMEX project. Dr. J. Marshall Shepherd participated in a NASA Press Briefing at the Naval Air Station-Jacksonville, FL, in August. The press briefing, organized by NASA HQ, kicked off the CAMEX-4 Field Experiment. CAMEX-4 employed NASA and NOAA aircraft, satellites, and ground assets to study Atlantic Basin hurricanes from August through September. Dr. Shepherd spoke about the role of TRMM in extending knowledge of hurricane intensification and evolution processes and how field campaigns like CAMEX-4 contribute to TRMM validation and calibration efforts. The press briefing also included remarks by NASA program manager Dr. Ramesh Kakar, Robbie Hood (MSFC), Dr. Ed Zipser (University of Utah), and Dr. Frank Marks (NOAA). At another time, Gerry Heymsfield was interviewed by Fox Morning News on the CAMEX field program in Florida.

Some of our public outreach addressed the topic of ozone. Dr. Paul Newman gave a talk to the Montgomery County Science Teachers Association in Lansdale, Pennsylvania, on stratospheric ozone. About 100 attendees were present. Jay Herman and Paul Newman were interviewed for an article on ozone in Discover Magazine. Paul Newman and Scott Janz were interviewed by Allison Aubrey of National Public Radio on the Antarctic ozone hole. She was shown the SSBUV instrument in the clean room and the tunable diode laser in the laser lab. Jay Herman was interviewed, live and delayed, by CNN on August 15 concerning the distribution and trends in UV radiation reaching the Earth's surface. CNN showed the images on the GSFC Web site pertaining to TOMS data.

Dr. W. Lau (Code 913) and Dr. P.K. Bhartia served as panelists on an Asian Pacific Media Workshop in June at GSFC. Dr. Lau presented a talk on "Rainfall and Climate," and Dr. Bhartia a talk on "Ozone and Atmospheric Chemistry." The event was organized by the GSFC Asian American Advisory Committee, in conjunction with the Public Affairs Office, to promote science and engineering outreach to the Asian-Pacific-American and the larger community. More than 10 representatives from Asian-Pacific-sponsored newspapers, magazines, and TV stations participated in the workshop. The presentations were followed by questions and answers, and a tour of the GSFC facilities.

On Sunday, May 6, Lorraine Remer (913) delivered the keynote address to the Girl Scouts of Central Maryland Gold Award Banquet. This event honors the 61 high school Girl Scouts within the Council who have earned Girl Scouting's highest honor during the past year. Lorraine spoke of her own Girl Scout experiences and how these early challenges have helped her succeed as a woman scientist in a male-dominated field.

### **TRMM Outreach/Education**

TRMM continues its comprehensive Education/Outreach program, in which Laboratory personnel promote TRMM science and technology to the public under the leadership of the TRMM Project Scientist Robert Adler (910) and TRMM Education and Outreach Scientist Jeffrey Halverson (912/JCET). TRMM has included the development of broadcast visuals and educational curriculum focusing on the Tropical Rainfall Measuring Mission. These packages are available on the TRMM Web site (<http://trmm.gsfc.nasa.gov/>) and have been reviewed as a part of the ESE Education product review. They are currently under revision. TRMM scientists regularly appear on major media outlets (Earth and Sky Radio, CBS, NBC, ABC, and CNN) in support of the mission. In addition, Laboratory personnel have spoken at and conducted several outreach workshops in support of TRMM. Dr. J. Marshall Shepherd released a new Web site highlighting current mesoscale and TRMM-related research on rainfall modification by urban areas. The Web site address is <http://rsd.gsfc.nasa.gov/912/urban>. This Web site was completely

designed and implemented by one of the Mesoscale Atmospheric Processes Branch's summer high school interns as a part of the Branch and Laboratory's outreach initiatives.

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### **GOES Web Server**

This Web server continues to provide GOES images online, including full-resolution images of all sectors of the United States for the most recent 2 days. In addition, there are extensive scrapbooks of digital movies and pictures of important weather events observed by the GOES-8 and GOES-9 satellites since they were launched in 1994 and 1995, respectively. The Remote Sensing Data (RSD) server (<http://rsd.gsfc.nasa.gov>) has been judged by NASA HQ to be one of the 20 most popular NASA Web sites during the year 2000. The science administrator of RSD supplies GOES-derived high-quality graphics and severe storm animations to the Visualization Analysis Laboratory (VAL), to GSFC Public Affairs Office (PAO), and directly to the public via the Internet. During active hurricanes, the GOES section of the RSD Web server is accessible to the general public.

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### **EOS Terra/Aqua Outreach Synopsis**

The EOS coordinated outreach effort—under the direction of Yoram Kaufman (Code 913), Claire Parkinson (Code 971), and David Herring (Code 913)—is a coordinated effort to foster greater cooperation and synergy among the various outreach groups within the EOS community. A sampling of these activities, described below, represents contributions from the diverse EOS community.

The Terra Project Science Office (Code 900) produced a Terra mission overview brochure. The brochure, as well as many more images, animations, and information, is available on the Terra Web site (<http://terra.nasa.gov/>), which is also maintained by the Terra Project. The Aqua project scientist and outreach scientist have also developed an EOS Aqua overview brochure.

The Terra and Aqua project teams created NASA's Earth Observatory Web site (<http://earthobservatory.nasa.gov/>). This Web environment is the NASA Web portal where the general public goes to learn about the Earth. It showcases new images and science results from EOS missions. All resources produced for the Earth Observatory are freely available for use by the EOS community, museums, educators, public media, regional "stakeholders," environmental awareness groups, and interested members of the general public. While leadership for this site resides in Code 913, significant contributions to its development come from Codes 900, 902, 912, 921, 922, 923, 935, 971, and 3200 at the Jet Propulsion Laboratory, as well as the American Museum of Natural History and East Carolina University.

To provide overarching guidance and review for the Terra outreach activities, as well as to flag mature new science results ready for public release, an Executive Committee for Science Outreach (ECSO) continues to operate. This committee is chaired by Dr. V. Ramanathan, of the Scripps Institute's Center for Clouds, Chemistry, and Climatology. The purpose of this committee is to harvest new Terra science results that are ready for public release, as well as to help temper the presentation of new results with respect to socio-political implications they may have. The major EOS outreach Web sites are (1) the Terra homepage (<http://terra.nasa.gov/>), (2) the Earth Observatory (<http://earthobservatory.nasa.gov/>), and (3) the Visible Earth (<http://visibleearth.nasa.gov/>). The Visible Earth site provides access to THE SUPERSET of all Earth science images, animations, and data visualizations produced by NASA for public release.

The Terra Project formed a Rapid Response Network to meet the media's requirements for quick access to satellite imagery relevant to newsworthy Earth events (e.g., severe storms, floods, El

Niño, volcanic eruptions, wildfires, etc.). The Network is headed by David Herring (Code 913), assistant Terra project scientist. This network enables us to access and produce remote-sensing imagery over targets of interest within hours to days after acquisition. As an example, MODIS fire detection was used during the 2001 fire season for the first time on an operational basis by the Forest Service to detect fires and smoke and to distinguish old from new fires. In a collaboration between the GSFC DAAC (Chris Lynnes et al.), MODIS processing team (Ed Masouka et al.), Terra outreach group (D. Herring et al), MODIS fire team (Chris Justice–UMD, Yoram Kaufman–GSFC et al.), and the U.S.D.A. Forest Service fire laboratory (Wei-Min Hao et al.), we had started an experimental delivery of MODIS data at the end of the 2000 fire season. Therefore, the Forest Service invested in a direct broadcast station and software for optimal use of the MODIS fire information. With the launch of Aqua there will be 4 MODIS observations of fires in 24 hours (2 observations of smoke and burn scars). Combined with the GOES fire observations, they make a powerful tool for scientific investigation and operational use. Terra's rapid response story received good play in the news media, including a short stint in the news block of ABC's Good Morning America. Most of the stories appeared on ABC affiliates and independent stations. Washington's WTTG Fox affiliate came out to the center and interviewed some of the rapid response team.

A Terra Engineering Competition was held in April at DuVal High School. There were teams of students competing from five different high schools around the state. David Herring played a lead role in defining both Round 1 and Round 2 problems, judging the entries of the students, and presiding over the last day's activities. The Competition was supported by Paul Ondrus, Code 500, EOS Operations Manager, and planned in collaboration with Ron Erwin, Technology Education Specialist, Code 100. The team from Westminster High School won the competition, with the Technology Magnet Program of the Howard County Public School System taking first runner up, and Perry Hall High School taking second runner up.

### **EOS Aura Education and Public Outreach Synopsis**

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The Laboratory for Atmospheres has responsibility for conducting the Education and Public Outreach program for the EOS Aura mission. Aura's Education and Public Outreach program has four objectives. The first objective is to educate students about the role of atmospheric chemistry in geophysics and the biosphere. The second objective is to enlighten the public about atmospheric chemistry and its relevance to the environment and their lives. The third objective is to inform geophysics investigators of Aura science, and thus enable interdisciplinary research. The final objective is to inform industry and environmental agencies of the ways Aura data will benefit the economy and contribute to answering critical policy questions regarding ozone depletion, climate change, and air quality.

To accomplish these objectives, the Laboratory has partnered with several institutions, which have established infrastructures that reach large audiences through formal and informal education. The GLOBE program and the American Chemical Society (ACS) will carry out formal EOS Aura education outreach effort. Grants are now in place with the American Chemical Society (ACS), the Smithsonian's NMNH, and the GLOBE Program, via Drexel University, for the various educational and public outreach activities relating to atmospheric chemistry and the Aura mission. The grants will result in educational material that will reach tens of thousands of students and millions of members of the general public over the next 3 years through the Aura launch.

GLOBE is a worldwide network of students, teachers, and scientists working together to study and understand the global environment. Students and teachers from over 9,500 schools in more

than 90 countries are working with the science community to learn more about the environment by making observations at or near their schools and reporting their data through the Internet. A protocol is being developed for students to measure UVB and overhead aerosols in collaboration with Aura research. The protocol will help students understand the implications of ozone and aerosol changes and their relationship to incident UVB. This student data could also be valuable for validating Aura data. Since the Aura mission involves partners from Europe, their education and public outreach programs will also support the GLOBE international components.

The ACS distributes its teaching magazine, *ChemMatters*, to 30,000 high school teachers. Over the next 3 years, the ACS will produce four issues of *ChemMatters* highlighting topics related to atmospheric chemistry, including space-flight technology, remote-sensing methods, ozone and climate observations, and forthcoming results from Aura measurements. Teachers are also provided with a lesson plan that describes atmospheric chemistry in relation to ozone depletion, air quality and climate. The first issue of *ChemMatters* was published in 2001. Electronic versions of the magazine and a teachers guide appear at <http://www.acs.org/education/curriculum/chemmatt.html>. Click on the September 2001 issue and teachers guide.

Our outreach to the general public will also include an exhibit at the Smithsonian's NMNH. The museum has millions of visitors per year. Our exhibit will include a large display that illustrates the connections among land, ocean, and atmosphere. The exhibit will also include an interactive module that deals with Aura's three main science questions. The Laboratory's VAL will develop the digital interactive displays. The museum will also develop a tool kit that will allow the display to be portable and, thereby, available to other museums in the U.S. and abroad. For further information, see the Aura Web site at <http://eos-aura.gsfc.nasa.gov/outreach/>, and for visualization visit the Web site at <http://rsd.gsfc.nasa.gov/rsd/>.

### **NASA/NOAA: Earth Science Electronic Theater 2001**

The NASA/NOAA/AMS Earth Science Electronic Theater (E-Theater) uses interactive computer-driven displays at near-IMAX size to deliver a powerful tool for promoting Earth science. Scientists from the various Earth science disciplines work directly with the VAL team to develop scientifically accurate visualizations. E-Theater visualizations are rendered at High Definition TV (HDTV) quality, the highest resolution possible. The visualizations can be used in a host of other applications (i.e., National Television Standards Committee (NTSC) TV, QuickTime movies, Web graphics, etc.). QuickTime versions of each E-Theater visualization are being added to the E-Theater Web page (<http://Etheater.gsfc.nasa.gov/index.html/>) along with an explanation of the scientific significance and the origin of the data.

Our Laboratory's VAL, as well as other Goddard and NASA groups, has produced visualizations using NASA, NOAA, ESA, and NASDA Earth science data sets. These visualizations continue to be shown around the world using new display technologies. The E-Theater has been presented at universities, high schools, museums, and government laboratories to scientists and the general public. An HDTV video was run on the 42" plasma screen at the NASA/HQ showing Landsat mosaics and panels explaining ESE's Science, Missions, Technology, and Applications. NASA/NOAA/AMS Earth Science Electronic Theater presentations were made at the AMS Satellite Conference in Madison, Wisconsin, and to middle- and high school students from all over Wisconsin in four daytime presentations. Presentations were also shown in the IMAX Theater of the Science Museum of Minnesota (SMM) in a public presentation in conjunction with the Earth Science Institute GIS Conference for Science Museums in November 2001. Fritz Hasler (VAL/912) and Steve Brill (EOS Program Office/420) made a successful NASA/NOAA/AMS



“Digital Earth Science” presentation in February 2001, at the Digital Theater Division of Evans & Sutherland in Salt Lake City, where the concept “Blue Marble Olympics” was put forth to the Salt Lake Organizing Committee and others. Subsequently, E-Theater presentations were made during the Winter Olympics in 2002.

We continue to demonstrate methods for visualizing and interpreting immense HyperImage remote-sensing data sets and 3-dimensional numerical models. We call the data from many new Earth-sensing satellites *HyperImage* data sets, because they have such high resolution in the spectral, temporal, and spatial domains. The traditional numerical spreadsheet paradigm has been extended to develop a scientific visualization approach for interactively processing HyperImage data sets and 3-D models. The advantages of extending the powerful spreadsheet style of computation to multiple sets of images and organizing image processing were demonstrated using the Distributed Image SpreadSheet (DISS). The DISS is being used as a high-performance testbed application for the Next Generation Internet (NGI).

### **Museum Support**

The VAL actively works with several museums in creating new, innovative Earth science displays. A short list of some of these museums includes the Smithsonian’s NMNH, the National Air and Space Museum, the American Museum of Natural History in New York, the Virginia Science Center, and the Houston Museum of Natural History. In conjunction with large museums, we are developing science presentations that will be made accessible and available to smaller museums.

One successful museum activity is the “Earth Today” exhibit. This exhibit evolved from an earlier Smithsonian exhibit, the “HoloGlobe.” The Earth Today is a permanent exhibit in the National Air and Space Museum. It contains all of the original information contained in the “HoloGlobe” exhibit, and it has expanded the focus to include near real-time data displays. These near real-time data presently include global cloud cover, global water vapor, sea surface temperature, sea surface temperature anomalies, biosphere, and earthquakes. VAL personnel continue to actively promote advancements in this exhibit. These refinements include improved computer coding; new, high-resolution data sets (such as products from TRMM, TOMS, Terra and in the future, Aqua); a new version of Earth Today that will run on many mid-level PCs; and a version that will run on the Web.

Another effort is “Global Links.” Global Links is an exhibition in the planning phase at the Smithsonian’s NMNH. This exhibit will feature the four main Earth science spheres: atmosphere, biosphere, hydrosphere, and geosphere. The exhibit will focus on these different systems and explain what we know about the interdependency and delicate balance among these systems. VAL staff worked closely with the museum and NASA scientists to develop the initial concepts used in this exhibit. VAL personnel continue to work with the museum in refining those concepts. The Global Links exhibit provides the perfect opportunity to develop strong content to explain Earth science concepts.